BioSentinel: Biosensors for Deep-Space Radiation Study

Melissa P. Lokugamage[1,2], Sergio R. Santa Maria[3], Diana B. Marina[3] and Sharmila Bhattacharya[3]
[1]Space Life Sciences Training Program (SLSTP), NASA Ames Research Center**,**
[2]Biological Engineering Department, University of Missouri, Columbia, Missouri**,** [3]Space Biosciences Division, NASA Ames Research Center.

The BioSentinel mission will be deployed on NASA's Exploration Mission 1 (EM-1) in 2018. We will use the budding yeast, *Saccharomyces cerevisiae,* as a biosensor to study the effect of deep-space radiation on living cells. The BioSentinel mission will be the first investigation of a biological response to space radiation outside Low Earth Orbit (LEO) in over 40 years. Radiation can cause damage such as double stand breaks (DSBs) on DNA. The yeast cell was chosen for this mission because it is genetically controllable, shares homology with human cells in its DNA repair pathways, and can be stored in a desiccated state for long durations. Three yeast strains will be stored dry in multiple microfluidic cards: a wild type control strain, a mutant defective strain that cannot repair DSBs, and a biosensor strain that can only grow if it gets DSB-and-repair events occurring near a specific gene. Growth and metabolic activity of each strain will be measured by a 3-color LED optical detection system. Parallel experiments will be done on the International Space Station and on Earth so that we can compare the results to that of deep space.

One of our main objectives is to characterize the microfluidic card activation sequence before the mission. To increase the sensitivity of yeast cells as biosensors, desiccated yeast in each card will be resuspended in a rehydration buffer. After several weeks, the rehydration buffer will be exchanged with a growth medium in order to measure yeast growth and metabolic activity. We are currently working on a time-course experiment to better understand the effects of the rehydration buffer on the response to ionizing radiation. We will resuspend the dried yeast in our rehydration medium over a period of time; then each week, we will measure the viability and ionizing radiation sensitivity of different yeast strains taken from this rehydration buffer. The data obtained in this study will be useful in finalizing the card activation sequence for this mission.

Supported by the Space Life Sciences Training Program at NASA Ames Research Center.